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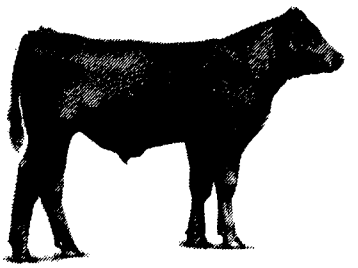

Beef Cattle Management Update

THE ROLE OF ANGUS CATTLE IN COMMERCIAL BEEF PRODUCTION

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INTRODUCTION

The beef cattle industry has undergone substantial change in the past decade and future change may occur at an even more rapid rate. Changes in consumer demands and attitudes, coupled with changes in the economy of the cattle industry, have forced all cattle producers to reassess their future. Traditionally thought of as a medium size, maternal breed, Angus has been the dominant breed in the traditional beef industry, but what about the future? Will changes in the industry reduce or increase the importance of Angus cattle? How should the Angus breed respond to changes in the industry?

SCOPE OF THE BREED

Before describing the role of Angus cattle in commercial beef production, the relative importance of the breed should be considered. Angus cattle comprised 12.5% of all purebred cattle registrations in 1988-89 (table 1). The total registration, 143,520 head, comprises 21.9% of all beef cattle registered in that year. When Red Angus are included, this proportion rises to 24.0%. In FY 1989, the American Angus Association reported sales of 12,652 registered Angus bulls (at an average price of $2069/head for a total value of over $26 million). One can only guess how many unregistered purebred Angus cattle were sold. Clearly, the Angus breed is an important one, and the Angus industry is large.

HOW DO ANGUS COMPARE IN ECONOMICALLY IMPORTANT TRAITS?

Beef cattle traits that affect profitability have historically been divided into groups: reproduction, growth (which includes milk) and carcass. In the order listed, the groups are

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ranked from most to least important to profitability (in the approximate proportion of 10:4:1), and from least to most heritable. In other words, reproductive rate has the most influence on profitability in commercial beef production, but is least responsive to selection (or most dependent on management and environment). Carcass traits, which can be rapidly changed through selection, have historically had the least influence on profit. It is anticipated that the relative importance of carcass traits will increase, whether it will surpass the importance of growth or reproduction is unknown.

It seems reasonable to add a fourth group of traits, which will be called convenience traits, for lack of a better term. This group would include structural, mouth and udder soundness, disposition, ability to calve without assistance, calf vigor and survivability, resistance to disease or parasites and other traits. Although little research has been conducted, the relative economic importance of these traits must be high.

Very few research studies have compared purebred Angus to other purebreds. In most cases, Angus x Hereford (AxH) crossbreds are compared to other crosses. The influence of Angus and Hereford are difficult to separate.

Reproductive traits. The low heritability of reproductive performance suggests that differences among groups of cattle are primarily due to management or environment, rather than genetics. This would suggest that all breeds are alike in terms of reproductive performance, or that differences are minimal. It is likely that differences between breeds have been underestimated, but no research data to prove this point exist.

Practical experience suggests that fertility is a strength of Angus cattle. Research at the U.S. Meat Animal Research Center (MARC) in Clay Center, Nebraska, has shown that AxH crossbreds are intermediate among 16 breed types tested in terms of age and weight at puberty and the percentage pregnant at 550 days of age (table 2 included a partial list). In this study, the AxH heifers reached puberty at an average age of 357 days, sufficiently early to allow them to calve as two-year-olds if so desired. Purebred Angus cattle were not evaluated in this study.

Keep in mind that reproductive rate is dependent on a proper match between the environment and the nutrient requirements of the female. Researchers at MARC utilized typical diets and growing conditions when evaluating breeds. In the Upper Midwest, Angus cattle are well matched to the environment, and are thought to be highly fertile.

Growth traits. The MARC study found AxH crossbreds to be below most breed types in terms of 200 day weight, post-weaning ADG and 452 day weight (table 4). This should not be particularly surprising, since the Angus and Hereford sires used in this evaluation were born in the 1960's and 1970's. Because of intense within-breed selection for increased size and growth in the past three decades, the current population of Angus cattle may compare more favorably. The Angus genetic trend (change in breed average EPD for a given trait) shows an increase in yearling weight EPD of 29.3 lb over the past 17 years. These data are summarized annually and can be seen in any recent Angus Sire Evaluation Report. This change reflects the selection for increased growth within the breed. The rate of change in the Angus breed is greater than in most other breeds, twice as great as some. In other words,

Angus cattle are catching up to some of the traditional high growth breeds.

Because of this trend, researchers at MARC compared "current" Angus and Hereford sires to "original" Angus and Hereford sires, and to sires of other breeds. Current sires were born in the mid-1980's and thus reflected changes that had taken place. The growth data from this evaluation are shown in tables 10 and 11. Use of current sires lessened, but did not completely remove, the difference in growth between Angus and Hereford and breeds such as Charolais and Simmental.

Angus cattle have traditionally been thought of as a maternal breed, with greater milk production than other breeds with similar size and growth. Research data bear this out. Through proper use of milk EPD's, Angus breeders should develop cowherds that have predictable milk production, at whatever level they choose.

When choosing the desired level of milk production in your herd, remember that more is not always better. Since EPD's allow more rapid progress than any other selection tool, they allow breeders to attain too much of any trait most rapidly. That is why analyzing your production situation properly and choosing appropriate production goals is important. Not all environments can support increased growth or milk production. Not all labor situations can tolerate calving difficulty. Following is a characterization of the effect of the milk EPD of an Angus sire on his daughter's production:

Sire's milk EPD	Effect on daughter's production average prior to any selection or culling.
+15 and above	Rarely needed commercially - use only in herds very low in milk.
+10 to +14	Calves wean in excellent condition in relation to genetic capability for growth. A few daughters may have difficulty breeding back unless their nutrient requirements are met, particularly at younger age.
+5 to +9	Suitable to many range conditions and allows the more growthy calves to express their genetic potential. Regular reproductivity is sustained.
-5 to +4	Adequate under most range conditions to wean a healthy, good-doing calf.
-10 to -6	Calves' frame growth may be expressed but generally not carrying the condition/weight that more milk usually provides.
-15 to -11	Under less than ideal conditions, calves show some signs of milk shortage and some reduction in frame and growth potential.
-20 to -16	Calves show signs of nutritional shortages, rough hair coats and reduced growth potential, particularly from first-calf heifers.
-21 and below	Unthrifty calves with poor weaning weights - some stunting appears depending on environment; additional feeding may be required to obtain potential growth.

Carcass traits. Carcass traits can be grouped into two general classifications: cutability traits (muscling and leanness) and quality traits (marbling). Most textbooks list carcass traits as high in heritability (.5-.7), suggesting that rapid progress could be made through selection. However, estimates of heritability within the Angus breed are .30, .33, and .32 for fat thickness, marbling score and ribeye area, respectively. These heritability values would be considered moderate, suggesting that progress could be made but would be slower than in other breeds. The likely reason for this reduced heritability is less variation in these traits within the Angus breed than others.

Because of negative genetic correlations between the traits, cutability and quality traits are thought to be antagonistic. That means that selection to improve leanness or muscling will result in reduced marbling, or vice versa. While this may be true across breeds, it appears not to be true within the Angus breed. The Angus genetic correlation between fat thickness and marbling is .04, indicating that the traits are virtually unrelated. The Angus genetic correlation between ribeye area and marbling score is -.06. Thus Angus breeders may be able to simultaneously improve cutability and marbling through selection. A more reasonable approach might be to strive to improve cutability while maintaining marbling at current levels, allowing greater progress in selecting for leanness and muscling.

Despite moderate to high heritability, within breed change in carcass traits typically comes slowly. Historically, this has been due to slight or nonexistent economic incentives to improve carcass traits. These incentives are increasing and will probably continue to increase. Use of carcass EPD's is the most effective means to make change in carcass traits. However, carcass EPD's have had little practical impact on selection programs. The reason for this is the length of time required to obtain sufficient data to calculate a fat thickness, ribeye area or marbling score EPD. This results in carcass EPD's reported only on fairly old bulls. Due to the rapid turning of generation intervals (which has contributed to rapidly increased growth in Angus cattle) most bulls have fallen out of favor by the time their carcass EPD's are reported. The 1989 Angus Sire Evaluation Report states that since 1974, only 483 Angus sires have been evaluated for carcass merit of their progeny.

A potential opportunity to change this situation would be to utilize data from ultrasound evaluation of live breeding cattle in calculation of EPD's, rather than waiting to slaughter their offspring. Currently there are three drawbacks to this approach. The first is the ultrasound technology, which seems adequate to estimate muscling and fatness in most cases but technology to accurately assess marbling is not yet widespread. There is also substantial variation found between ultrasound technicians, which is being reduced through use of certified technicians. The second drawback is the cost of the equipment. The third is that the relationship between carcass traits of a live bull or heifer and their subsequent progeny is virtually unknown, especially for marbling. Research designed to address this issue is currently being conducted.

Angus breeders should take a long, hard look at their priorities before they attempt substantial change in the carcass traits of their cattle. There are substantial differences in carcass traits among breeds, while within breed differences are smaller. Thus it would take approximately 35 years of selection to make Angus cattle similar to Chianina, or vice versa. It is the opinion of the authors that a commercial cattleman seeking to improve the leanness and

muscling of his crossbred steer calves would not choose an Angus bull for that purpose and that the Angus breed would likely lose some of their greatest attributes if they seek to become the breed to fill that particular need in the future. That does not mean that Angus breeders should ignore carcass traits. On the contrary, increased muscling within the breed would allow commercial producers to maintain high concentrations of Angus blood in their herds while also producing premium carcasses. This should be approached cautiously, however. Rampant selection and widespread use of the most muscular cattle within the breed could lead to other problems. The most prudent approach would be to cull the least muscular females in each herd and to avoid using light muscled bulls. There are Angus cattle with plenty of muscling, however, there are also far too many light muscled cattle within the breed.

The Certified Angus Beef (CAB) program has received considerable attention in recent years. Potential CAB premiums for carcasses, feeder calves and commercial bulls have caused purebred and commercial producers to consider CAB standards in their feeding and breeding programs. CAB standards require that carcasses be from black or predominately black cattle, contain at least Modest marbling (this would place carcasses from young cattle in the upper 2/3 of the USDA choice grade), and be yield grade 3 or better. Although these standards are not particularly stringent, only 20% of carcasses from cattle that are certified live meet CAB standards. Increasing the percentage of slaughter cattle that meet CAB standards would seem a reasonable goal for Angus breeders.

Convenience traits. Birth weight (BW) can be thought of as a growth trait but calving difficulty, which is obviously closely related should probably be thought of as a convenience trait. The genetic trend for BW EPD within the Angus breed over the last 16 years has increased from 0.0 to +3.6 lb. This has been accompanied by an increase in the average adjusted birth weights of 14 lb for bulls and 12 pounds for heifers. The potential for calving difficulty has increased as well. Appearance of bulls with BW EPD's as high as +10 lb suggests that some Angus bulls could cause substantial calving difficulty in herds of small cows or when mated to heifers. Use of EPD's to maintain a reasonable and manageable range of birth weights is recommended.

Other convenience traits should be considered as well. Structural correctness and soundness, and how these traits affect productivity have become a major concern. Many of the show cattle within the breed, including a number of widely used recent champions, have severe structural defects. In an attempt to increase the frame size of the cattle, emphasis on feet and leg structure was reduced. This may not be a problem in many herds, but should be considered in all selection decisions.

Angus cattle have been correctly portrayed as a superior maternal breed and have had few problems with udder soundness. This has been appreciated by many commercial producers and is one of the main reasons that the breed is so popular in commercial beef production. However, udder and teat soundness should never be overlooked. As milking ability of the breed has increased some lines of cattle within the breed have shown indications that udder soundness has become poorer. Often, as milk production increases the structure and soundness of the udder begins to fail, thus decreasing longevity. One recommendation that has already been mentioned, is to match milk production to pasture and feed availability.

Also by avoiding bulls that are extreme for milk production, udder soundness should remain a very positive aspect of the Angus breed.

Disposition is another trait that is difficult to measure but should be closely watched. This has not been a problem with the Angus breed as a whole, but like any breed certain individual sires are known for their poor disposition and the disposition of their offspring. These individuals should be used with reservation or not at all, and offspring should be watched closely to keep a potential problem under control.

Selection emphasis on convenience traits will vary from one herd to another. These traits are very dependent on management practices.

Consider the demands of your commercial customers when evaluating the importance of these traits. In the opinion of many, these traits are very important to the economic profitability, and survivability of Angus or any other breed of beef cattle.

SUMMARY

Angus cattle have enjoyed a position of dominance in the U.S. beef cattle industry. Due to changes in the industry, Angus breeders should rethink the role of Angus cattle and define an ideal based on their projection of the future. If Angus cattle are to remain a medium sized, maternal breed, emphasis on maternal traits, convenience traits and marbling would likely be appropriate. Frame size should be matched to environment but may not require further increases. Genetic variation exists to allow Angus breeders to convert the breed to a high growth, high muscle paternal breed but Angus breeders should seriously consider what will be lost if they choose that path.

SUGGESTIONS FOR ANGUS BREEDERS

Three suggestions are offered that apply to breeders of any breed or species of livestock:

1) Avoid extremes.
2) Choose priority traits and select to improve them; do not try to make your breed the best in all traits or the breed will become mediocre in all traits.
3) Do not rest on past success.

More specific suggestions for Angus breeders:

Use EPD's in selection. Visit with commercial bull customers to determine their EPD requirements and breed cattle to meet them. Educate commercial (and fellow purebred) producers who do not use or understand EPD's.

Match mature cow size to your environment and your market. Within the appropriate size, select for rapid growth.

Increase emphasis on muscling, but not at the expense of other important traits. Culling light muscled females and avoiding use of light muscled bulls is the most prudent

approach.

Obtain, and report to the American Angus Association, as much carcass data as possible so that carcass EPD's can be more accurate and complete.

Maintain or increase selection emphasis on convenience traits. It is the opinion of some that structural and functional soundness of Angus cattle are at an all time low.

Continue to develop the CAB and CAF (Certified Angus Feeder) programs. However, success of these programs will ultimately be based on increasing returns to commercial or purebred producers. This will occur either directly or through increased demand for beef.

TABLE 1. U.S. PUREBRED CATTLE REGISTRATIONS

Breed	No. of 1988-89 registrations	No. of total registrations
Holstein	392,883	34.2
Angus	143,520	12.5
Hereford	97,424	8.5
Simmental	75,273	6.6
Polled Hereford	74,937	6.5
Jersey	57,236	5.0
Limousin	53,136	4.6
Charolais	39,605	3.5
Beefmaster	35,481	3.1
Brangus	26,100	2.3
Salers	18,482	1.6
Santa Gertrudis	18,003	1.6
Gelbvieh	17,545	1.5
Guernsey	16,644	1.4
Brahman	16,425	1.4
Shorthorn	15,113	1.3
Red Angus	14,004	1.2
Brown Swiss	12,376	1.1
Ayrshire	7,849	0.7
Chianina	7,427	0.6
Milking Shorthorn	3,524	0.3
Red Poll	1,500	0.1
Pinzgauer	1,280	0.1
Murray Grey	900	0.08
Scotch Highland	600	0.05
TOTAL	1,147,267	100.00

National Pedigreed Livestock Council, 1989.

TABLE 2. PUBERTY AND FERTILITY OF HALF-BLOOD HEIFERS, U.S. MARC[a]

Breed of heifer	Age at puberty		Weight at puberty, lb.	Pregnant at 550 days, %
	Days	Ratio[b]		
Jersey-X	308	86	518	80.6
Gelbvieh-X	326	91	626	93.2
Holstein-X	341	96	662	94.1
Angus-Hereford-X	357	100	622	87.2
Simmental-X	358	100	666	80.4
Charolais-X	384	108	703	74.8

[a] Cundiff et al, 1986.
[b] Angus X Hereford = 100

TABLE 3. PREWEANING AND WEANING TRAITS OF 2-YR-OLD HALF-BLOOD COWS, U.S. MARC[a]

Breed of cow	% calving difficulty	% calves weaned	Calf wt. ratio	Lb. calf per cow exposed	% cows preg.
			Angus X Here. = 100		
Holstein-X	43	84	118	129	94
Gelbvieh-X	55	78	115	126	99
Simmental-X	46	77	112	121	80
Charolais-X	44	69	107	104	83
Angus-Hereford-X	49	71	100	100	90

[a] Cundiff et al., 1981.

TABLE 4. PRE- AND POST-WEANING GROWTH OF HALF-BLOOD STEERS, U.S. MARC[a]

Breed of steer	200-d wt.	Post-weaning ADG	452-day final wt.
	Angus X Hereford = 100		
Charolais-X	107	111	109
Simmental	105	112	109
Gelbvieh-X	107	107	107
South Devon-X	98	108	103
Holstein-X	102	103	102
Angus-Hereford-X	100	100	100

[a] Cundiff et al., 1986.

TABLE 5. CARCASS AND RETAIL PRODUCT YIELD OF HALF-BLOOD STEER, U.S. MARC[a,b]

Breed of steer	Carcass wt.	Retail product, %	Retail product, wt.
	Angus X Hereford = 100		
Chianina-X	108	110	119
Simmental-X	106	107	113
Gelbvieh-X	108	105	113
Holstein-X	101	107	107
South Devon-X	103	102	105
Angus-Hereford-X	100	100	100

[a] Cundiff et al., 1986.
[b] Adjusted to constant age.

TABLE 6. MEAT QUALITY TRAITS OF HALF-BLOOD STEERS, U.S. MARC[a,b]

Breed of steer	Marbling	Percent grading Choice	Tenderness score[c]
Jersey-X	Ch°	85	7.4
South Devon-X	Ch-	76	7.4
Hereford-Angus-X	Ch-	76	7.3
Charolais-X	Ch-	63	7.3
Simmental-X	Ch-	60	6.8
Gelbvieh-X	Se+	43	6.9

[a] Koch et al., 1982.
[b] Adjusted to constant age.
[c] 2 = undesirable, 5 = acceptable, 9 = extremely desirable.

TABLE 7. BIRTH AND CALF SURVIVAL TRAITS OF HALF-BLOOD COWS, 6-7 CALF CROPS, (U.S. MARC)[a]

Breed of cow	Birth wt. ratio[b]	% calving difficulty	% calves born	% calves weaned
Gelbvieh-X	105	11	95	87
Holstein-X	107	10	95	86
South Devon-X	106	15	88	85
Simmental-X	106	17	89	83
Angus-Hereford-X	100	13	91	84
Charolais-X	108	15	88	80

[a] Cundiff et al., 1986.
[b] Angus X Hereford = 100

TABLE 8. PREWEANING AND WEANING TRAITS OF HALF-BLOOD COWS, 6-7 CALF CROPS, U.S. MARC[a]

Breed of cow	Milk, lb./d	Cow wt. ratio	Calf wt. ratio	Lb. calf per cow exposed
		Angus X Hereford = 100		
Holstein-X	--	105	113	115
Gelbvieh-X	16.6	105	112	115
Simmental-X	16.6	105	110	108
South Devon-X	13.0	103	104	104
Charolais-X	11.0	111	106	101
Angus X Hereford	12.2	100	100	100

[a] Cundiff et al., 1986.

TABLE 9. GENETIC CHANGE IN HEREFORD AND ANGUS BREEDS IN GROWTH AND CARCASS TRAITS AS REFLECTED BY PROGENY OF BULLS BORN IN LATE 1960's (ORIGINAL VS PROGENY OF BULLS BORN IN MID 1980's (CURRENT)[a]

Breed group	Final wt., lb.	Carc. wt., lb.	USDA Choice, %	Retail prod., %	Ext. fat, in	REA, sq. in
Hereford sires:						
Original	1030	645	60.2	71.4	.57	10.73
Current	1084	674	47.7	71.2	.51	10.74
Diff. (cur. - orig.)	+54	+29	-12.5	--	-.06	--
Angus sires:						
Original	1030	642	77.8	70.8	.57	10.86
Current	1100	680	77.1	71.3	.54	11.04
Diff. (cur. - orig.)	+70	+38	--	--	-.03	--

[a] Preliminary results from first 2 of 5 calf crops produced in Cycle IV of GPE study at MARC.

TABLE 10. PREWEANING TRAITS FOR F_1 CALVES CYCLE IV, U.S. MARC[a,b]

Breed of sire	Birth wt., lb.	Calving diff., %	Calf survival %	Weaning wt.	W.W. x surv.
				Ratio (Orig. H & A = 100)	
Original H & A[c]	78.9	4.1	94.9	100.0	100.0
Current H & A[c]	84.5	2.6	92.7	103.3	100.9
Charolais	88.8	8.5	88.0	108.5	100.6
Gelbvieh	87.9	1.6	93.4	108.2	106.5
Salers	83.6	1.5	93.0	106.5	104.3

[a] Cundiff et al., 1989.
[b] Avg. of 3 calf crops out of 3 - to 10-yr Angus and Hereford dams.
[c] Original sires born prior to 1969; current, since 1982.

TABLE 11. GROWTH TRAITS FOR F_1 STEERS, CYCLE IV, U.S. MARC[a,b]

Breed group	No. steers	200-d wt.	Post-weaning gain	Final wt.
		Ratio (Orig. H-A-X = 100)		
Original H-A-X	32	100	100	100
Current H-A-X	41	103	107	105
Charolais-X	36	108	114	111
Gelbvieh-X	65	108	106	106
Salers-X	36	106	105	105

[a] Cundiff et al., 1989.
[b] Avg. of 2 calf crops (1986-87); slaughtered at equal age.

TABLE 12. CARCASS TRAITS FOR F_1 STEERS, CYCLE IV, U.S. MARC[a,b]

Breed group	USDA Choice %	Ext. fat, in.	REA, sq. in.	W-B shear, lb.
Original H-A-X	71	.60	11.2	12.0
Current H-A-X	67	.56	11.0	13.7
Charolais-X	40	.41	12.5	13.8
Gelbvieh-X	32	.36	12.2	13.5
Salers-X	35	.43	11.9	14.0

[a] Cundiff et al., 1989.
[b] Avg. of 2 calf crops (1986-87); slaughtered at equal age.

TABLE 13. CARCASS AND RETAIL YIELD OF F_1 STEERS, CYCLE IV, U.S. MARC[a,b]

Breed group	Carcass weight (ratio)	Retail prod. % (ratio)	Retail prod. wt. (ratio)
	Original H-A-X = 100		
Original H-A-X	100.0	100.0	100.0
Current H-A-X	104.9	100.9	105.9
Charolais-X	110.8	105.4	116.8
Gelbvieh-X	106.7	106.0	113.1
Salers-X	106.1	105.6	112.0